CAUTION: This is a FISHER precision high-fidelity instrument. It should be serviced only by qualified personnel trained in the repair of transistor equipment and printed circuitry.

EQUIPMENT AND TOOLS NEEDED

The following are needed to completely test and align modern high-fidelity instruments such as amplifiers, tuners and receivers.

**Test Instruments**
- Vacuum-Tube Voltmeter (DC VTVM)
- Audio Vacuum-Tube Voltmeter (AC VTVM)
- Oscilloscope (Flat to 100 kc minimum)
- Audio (Sine-wave) Generator
- Intermodulation Analyzer
- Sweep (FM) Generator (88 to 108 mc)
- Marker Generator
- Multiplex Generator (preferably with RF output—FISHER Model 300 or equal).

**Miscellaneous**
- Adjustable-Line-Voltage Transformer or line-voltage regulator
- Load Resistors (2) — 8-ohm, 50-watt (or higher)
- Stereo source (Turntable with stereo cartridge or Tape Deck)
- Speakers (2) — Full-range, for listening tests
- Soldering iron (with small-diameter tip)
- Fully insulated from power line.

PRECAUTIONS

Many of the items below are included just as a reminder—they are normal procedures for experienced technicians. Shortcuts can be taken but often they cause additional damage—to transistors, circuit components or the printed-circuit board.

**Soldering**—A well-tinned, hot, clean soldering iron tip will make it easier to solder without damage to the printed-circuit board or the many circuit components mounted on it. It is not the wattage of the iron that counts, but rather the tip—so low on heat available at the tip. Low-wattage soldering irons will often take too long to heat a connection—pigtails leads will get too hot and damage the part. Too much heat, applied too long, will damage the printed-circuit board. Some 50-watt irons reach temperatures of 1,000°F — others will hardly melt solder. Small-diameter tips should be used for fine solder connections—larger pyramid and chisel tips are needed for larger areas.

- When removing defective resistors, capacitors, etc., the leads should be cut as close to the body of the circuit component as possible. (If the part is not being returned for in-warranty factory replacement it may be cut in half—with diagonal-cutting pliers—to make removal easier.)
- Special desoldering tips are made for unsoldering multiple-terminal units like IF transformers and electrolytic capacitors. By unsoldering all terminals at the same time the part can be removed with little chance of breaking the printed-circuit board.
- Always disconnect the chassis from the power line when soldering. Turning the power switch OFF is not enough. Power-line leakage paths, through the heating element, can destroy transistors.

**Transistors**—Never attempt to do any work on the transistor amplifiers without first disconnecting the AC-power linecord—wait until the power supply filter capacitors have discharged.

- Guard against shorts—it takes only an instant for a base-to-collector short to destroy that transistor and possibly others direct-coupled to it. (In the time it takes for a dropped machine screw, washer, or even the screwdriver, to glance off a pair of socket terminals or between a terminal and the chassis) a transistor can be ruined.
- DO NOT bias the base of any transistor to, or near, the same voltage applied to its collector.
- DO NOT use an ohmmeter for testing transistors. The voltage applied through the test probes may be higher than the base-emitter breakdown voltage of the transistor.

**Output Stage and Driver**—Replacements for output and driver transistors, if necessary, must be made from the same beta group as the original type. The beta group is indicated by a colored flange of the transistor. Be sure to include this information, when ordering replacement transistors.

- If one output transistor burns out (open or shorts), always remove all output transistors in that channel and check the bias adjustment, the control and other parts in the network with an ohmmeter before inserting a new transistor. All output transistors in one channel will be destroyed if the base-biasing circuit is open on the emitter end.
- When mounting a replacement power transistor be sure the bottom of the flange, the mica insulator and the surface of the heat sink are free of foreign matter. Dust and grit can prevent perfect contact. This reduces heat transfer to the heat sink. Metallic particles can puncture the insulator and cause shorts—ruining the transistor.
- Silicone grease must be used between the transistor and the mica insulator and between the mica and the heat sink for best heat conduction. Heat is the greatest enemy of electronic equipment. It can shorten the life of transistors, capacitors and resistors. (Use Dow-Corning DC-3 or C20194 or equivalent compounds made for power transistor heat conductance.)
- Use care when making connections to speakers and output terminals. Any frayed wire ends can cause shorts that may burn out the output transistors— they are direct-coupled to the speakers. There is no output transformer—nothing to limit current through the transistors except the fuses. To reduce the possibility of shorts at the speakers, lugs should be used on the exposed ends—at least the ends of the stranded wires should be tinned to prevent frayed wire ends. The current in the speakers and output circuitry is quite high. Any poor contact or shorts in the wiring can cause power losses in the speaker system. Use 14 or 16 AWG for long runs of speaker connecting wire.

DC-Voltage Measurements—These basic tests of the transistor circuitry are made without the signal generator. Without any signal input measure the circuit voltages—as indicated on the schematic. The voltage difference between the base and the emitter should be in the millivolt range—a sensitive DC meter is needed for these readings. A low-voltage range of 1 volt, full scale—or lower—is needed.

Audio-Voltage (Gain) Measurements—The schematic and printed-circuit board layout diagrams are used. Input signals are injected at the proper points—found most quickly by using layout of the printed-circuit board instead of the schematic. An AUDIO (AC) VTVM connected to the test points should indicate voltages close to those values shown in the boxes on the schematic. Many of the signal levels in the input stages are only a few millivolts— they can not be read on the AC ranges supplied on most Vacuum-Tube AC/DC Voltmeters (VTVMs). Even with a 1-volt range a signal level of 100 millivolts (1 volt) will be the first 1/10 of the meter scale. A reading of 1 millivolt (0.001 volt) will hardly even move the meter needle.
Replacing Dial Lamps

Before replacing the dial lamps, disconnect the power plug from the wall outlet. Proceed as follows:

- Remove all control knobs from their shafts, by pulling them gently away from the control panel.
- Remove the two screws located on the upper right side of the partition which separates the Turntable compartment from the control section.
- Slide the entire control panel (the plate and wood panel to which it is fastened) to the right and upward. The panel can then be lifted off to expose the chassis.
- The lamps, tubular in shape, are held in spring clips at either end of the dial glass, and can be removed by lifting gently.
- Install the new lamp, making sure that the white, painted side faces away from the dial glass. Press the lamp down until it snaps into place.
- Replace the panel by reversing steps above.

Replacement dial lamps can be ordered from Fisher Radio Corporation, Long Island City 1, New York. Please send all requests for parts to the attention of the Parts Department. The part No. is 150441-3.

Replacing Stereo Beacon Lamp

Before replacing the STEREO BEACON lamp, disconnect the power plug from the wall outlet. The lamp assembly is accessible from the rear of the cabinet. It is housed in a white cylinder on the chassis, directly below the dial, and located near the front of the set. Replace the lamp as follows:

- Locate the white cylinder described above. Follow the two leads which protrude from the rear of the cylinder to the chassis.
- Slide the clips, located on the other ends of the leads, off the terminal strip contacts by moving them gently away from the chassis.
- Remove the white flexible band which secures the bulb leads to the cylinder. Remove the bulb from the cylinder by pulling gently on the leads.
- Place the new bulb in the cylinder, and secure it with the flexible band removed in the previous step.
- Slide the clips on the bulb leads over the terminal strip contacts.

Replacement STEREO BEACON lamps can be ordered from Fisher Radio Corporation, Long Island City 1, New York. Please send all requests for parts to the attention of the Parts Department. The part number is 150461-3.

Replacing Fuses

POWER FUSE — To protect against line surges and other adverse conditions sometimes encountered by electronic equipment, the unit is fused at strategic locations. If it appears to be inoperative, check to see if the dial lamps light when the Volume control is turned clockwise from the AC OFF position. If the lamps do not light, the unit may have a blown power fuse. To replace the fuse, which is located in a black receptacle on the lower right-hand side of the Power Amplifier, proceed as follows:

- Turn the Volume control to the AC OFF position.
- Disconnect the power cord from the wall receptacle.
- Push the cap of the fuseholder in, and turn it counterclockwise. The cap will disengage, and you can pull it out, with the fuse remaining in its clip. Replace the fuse with a 3.2-amp Slo-Blo fuse only. Return the cap and fuse to the receptacle, and restore power to the set.

SPEAKER FUSES — If the dial is lit, yet one or both channels of the set does not play, no matter what program source (e.g., tuner, turntable, tape recorder, etc.) is used, it may be the result of a blown fuse in the output stage of the Power Amplifier. Power transistors could easily be destroyed if the EXTERNAL SPEAKER terminals were accidentally shorted to each other, or to the chassis. To protect the transistors, as well as the speakers, each output stage uses two fuses, which are contained in receptacles labelled FUSES FOR LEFT CHANNEL and FUSES FOR RIGHT CHANNEL. These fuses are precisely rated, and manufactured to function within extremely narrow tolerances. These fuses must be replaced only with fuses rated at 2 amperes. Replacement with any other type of fuse, or with Slo-Blo fuses of the same value, may result in damage to the unit, and voids the warranty. If either channel (or both) is inoperative, pull the power plug from the wall receptacle and remove both fuses used in that channel. Simply push the cover of each fuseholder down, rotate it counterclockwise, and lift it from its receptacle. Replace the fuse(s) with a known good fuse (two spare speaker fuses are supplied with your set). Additional fuses are available from your dealer as Fisher part No. F755-145 (2 amp), or from your local radio supplier. Next, plug the set in, and turn it on. Should distortion become apparent in either channel, replace one of the fuses in that channel as described above. If distortion is still apparent after restoring power to the set, replace the other fuse in the channel with the fuse removed.
Output Stage Balancing and IM Distortion Measurements

- Connect an 8-ohm, 50-watt resistor across the left output terminals. In parallel to the load resistor connect the input leads of an IM (Inter-Modulation) distortion analyzer and the leads of a DC VTVM capable of reading 0.1 volt with accuracy.
- Connect IM-analyzer generator output to the left Monitor input.
- Apply AC power and rotate Volume control to its maximum clockwise position—full volume.
- Increase signal input to amplifier for 20 watts output (12.5 VAC across 8-ohm load resistor). After one full minute of warm-up time proceed to next step. The warm-up time is very important to get proper balance — the characteristics of the transistors change slightly as their internal temperature rises. A longer warm-up time will not damage the transistors. Once they are warm the tests and adjustments should be completed without delay — before they can cool off.
- Reduce IM-analyzer generator output for 5 watts output from amplifier (5.16 VAC across load).
- Adjust P1 and P2 (P3 and P4 for right channel) for minimum IM distortion and zero DC voltage across the load. (IM distortion should be less than 0.8% and DC voltage lower than ±0.1 volts across the 8-ohm load. Use two screwdrivers to adjust the controls — it's faster than shifting from one control to the other.)
- Increase signal input for 40 watts output from amplifier. IM reading should be less than 1%—DC across load should be less than ±0.3 volt.
- Repeat steps 1 through 7 (above) for right-channel tests.

SEE OUTPUT-STAGE BASE-BIAS CIRCUIT MODIFICATION ON AMPLIFIER SCHEMATIC PAGE.

NOTE — If any of the above instructions are different from those supplied with the IM analyzer instruction manual, it is best to follow those in the manual. If a load resistor of 50-watts rating is built into the IM analyzer, a separate load resistor is not required for the channel under test — one should be wired across the other channel as a precaution. For best results the IM range switch should be set to give a reading in the center to full-scale portion of the meter scale — this gives greater accuracy.

Harmonic Distortion Test

- Connect an audio (sine-wave) generator to the left AUX input. Connect the harmonic-distortion analyzer to the left speaker #1 terminals across an 8-ohm, 50-watt resistive load.
- Apply AC power — rotate Volume control to its maximum clockwise position.
- Set the frequency control of the audio generator to 20 cycles. Adjust the output level for 40 watts (17.9 VAC) across the 8-ohm load. Harmonic distortion should be less than 1%.
- Repeat steps above for right-channel harmonic-distortion measurements.

Stability Test

- Connect audio (sine-wave) generator to the left AUX input. Across the left-speaker terminals connect an 8-ohm, 50-watt load resistor and the vertical-input leads of an oscilloscope.
- Set amplifier controls to positions listed above (control positions).
- Apply AC power — rotate Volume control to its maximum clockwise position — full volume.
- Set the frequency control of the audio generator to 20 cycles. Increase the output level of the audio generator until the sine waves, as viewed on the scope, start to distort — the peaks are clipped from overdriving the amplifier. Check waveforms on scope for instability — changes in wave shape or oscillation (thicker line at a portion of the waveform).
- Repeat the above steps using a 0.1-uf capacitor as a load. Remove the 8-ohm resistor.
- Repeat steps 1 through 5, above, for the right stereo channel.

Transistor Testing

If a power-transistor tester is not available the circuit given below can be used to determine the DC beta of the transistors. This is not a complete test of the transistor.

OPERATION: Connect the transistor to the test circuit. Adjust R2 for a 0.5-ampere reading on M2 in the collector circuit. The DC beta is then calculated by: DC beta = reading of M2 / reading of M1
The DC beta should be between 50 and 250.

```
IN 5W1
R2 R1
M1 M2
BATTERY
```

Voltage tests can be made with safety — without ruining transistors — by substituting resistors for the emitter-collector circuit of the power transistors.

Output Stage and Driver — Replacements for output and driver transistors, if necessary, must be made from the same beta group as the original type. The beta group is indicated by a colored dot on the mounting flange of the transistor. Be sure to include this information, when ordering replacement transistors.

If replacement parts are out of stock, locally, they may be obtained directly from the Parts Department of FISHER Radio. They will be shipped “best way”, either prepaid or C.O.D. unless otherwise specified.

For instrument-operation information and technical assistance write Richard Hamilton, Customer Service Department, FISHER Radio Long Island City, New York 11101.
MULTIPLEX SECTION

All circuit components with symbols beginning with 401 are located on the printed-circuit board, those beginning with 421 are mounted on the metal subchassis.

CAPACITORS

20% tolerance for all fixed capacitors, unless otherwise noted or marked GMV (guaranteed minimum value). All capacitors not marked uF are pF (uuf).

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C401</td>
<td>Capacitor, Mylar .047uF 10% 100V</td>
<td>C508574-5</td>
</tr>
<tr>
<td>C402</td>
<td>Capacitor, Polystyrene, 2700 5% 125V</td>
<td>C508634-20</td>
</tr>
<tr>
<td>C403</td>
<td>Capacitor, Plastic Film .1uF 20% 250V</td>
<td>C508633-1</td>
</tr>
<tr>
<td>C404</td>
<td>Capacitor, Cer. Disc., 1500, 10%</td>
<td>C508576-4</td>
</tr>
<tr>
<td>C405</td>
<td>Capacitor, Plastic Film .1uF 20% 250V</td>
<td>C508633-1</td>
</tr>
<tr>
<td>C406</td>
<td>Capacitor, Plastic Film .033uF 20% 400V</td>
<td>C508633-20</td>
</tr>
<tr>
<td>C407</td>
<td>Capacitor, Cer. Disc., 470 pF 10%</td>
<td>C508576-1</td>
</tr>
<tr>
<td>C408</td>
<td>Capacitor, Plastic Film .1uF 20% 250V</td>
<td>C508633-1</td>
</tr>
<tr>
<td>C409</td>
<td>Capacitor, Cer. Disc., 820 10%</td>
<td>C508576-3</td>
</tr>
<tr>
<td>C410</td>
<td>Capacitor, Cer. Disc., 820 10%</td>
<td>C508576-3</td>
</tr>
<tr>
<td>C411</td>
<td>Capacitor, Plastic Film .1uF 20% 250V</td>
<td>C508633-1</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C412</td>
<td>Capacitor, Cer. Disc., 470 pF 10%</td>
<td>C508576-1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C421</td>
<td>Mylar, .033 uF, 10%, 100V</td>
<td>C508574-11</td>
</tr>
<tr>
<td>C422</td>
<td>Polystyrene 180, 5%, 500V</td>
<td>C508634-21</td>
</tr>
<tr>
<td>C423</td>
<td>Polystyrene 4700, 5%, 125V</td>
<td>C508634-2</td>
</tr>
<tr>
<td>C424</td>
<td>Polystyrene 220, 5%, 500V</td>
<td>C508634-21</td>
</tr>
<tr>
<td>C425</td>
<td>Ceramic, .02uF, 20%, 200V</td>
<td>C508634-2</td>
</tr>
<tr>
<td>C426</td>
<td>Ceramic, 2200, 20%, 1000V</td>
<td>C508634-2</td>
</tr>
<tr>
<td>C427</td>
<td>Ceramic, 100, 20%, 1000V</td>
<td>C508634-2</td>
</tr>
<tr>
<td>C428</td>
<td>Ceramic, 120, 10%, 1000V</td>
<td>C508634-2</td>
</tr>
<tr>
<td>C429</td>
<td>Ceramic, 40, 10%, 1000V</td>
<td>C508634-2</td>
</tr>
<tr>
<td>C430</td>
<td>Ceramic, 39, 10%, 1500, 1000V</td>
<td>C508634-2</td>
</tr>
</tbody>
</table>

RESISTORS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>R401</td>
<td>Resistor, Dep. Carbon, 47K, 5%</td>
<td>R12DC473J</td>
</tr>
<tr>
<td>R402</td>
<td>Resistor, Dep. Carbon, 1.9M, 5%</td>
<td>R12DC473J</td>
</tr>
<tr>
<td>R403</td>
<td>Resistor, Composition, 22M, 10%, 1/2W</td>
<td>R12DC473J</td>
</tr>
<tr>
<td>R404</td>
<td>Resistor, Dep. Carbon, 470K, 5%</td>
<td>R12DC473J</td>
</tr>
</tbody>
</table>
GENERAL

The preferred alignment procedure, in table 1 below, uses a multiplexer generator with an RF output, like the FISHER Model 300. Optimum performance will be obtained only when the multiplexer decoder is connected to the FM detector with which it will be used. Check IF alignment first—poor alignment can prevent proper multiplexer decoder operation.

**TEST EQUIPMENT REQUIRED:** MULTIPLEX GENERATOR, AUDIO (AC) VTVM, 100 KC OSCILLOSCOPE WITH EXTERNAL SWEEP JACKS, ALIGNMENT TOOL.

**TABLE 1**

<table>
<thead>
<tr>
<th>STEPS</th>
<th>CONNECTION</th>
<th>MODULATION</th>
<th>RF DEVIATION</th>
<th>TYPE AND CONNECTION</th>
<th>ADJUST</th>
<th>INDICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Multiplexer generator RF output to antenna terminals</td>
<td>19 kc pilot only</td>
<td>±7.5 kc</td>
<td>VTVM to TP 421</td>
<td>Z 421 top and bottom</td>
<td>Maximum reading on VTVM</td>
</tr>
<tr>
<td>2</td>
<td>19 kc output of generator to oscilloscope horizontal input; generator not connected to MPX section</td>
<td>——</td>
<td>——</td>
<td>Vertical input of oscilloscope to 422; set oscilloscope for external sweep</td>
<td>Z 422</td>
<td>Set frequency of free-running oscillator as close as possible to 38 kc. Lissajous pattern (see figure 1) should be as slow-moving as possible.</td>
</tr>
<tr>
<td>3</td>
<td>Same as Step 1</td>
<td>Composite MPX; 1000 cps on left channel only</td>
<td>±75 kc</td>
<td>VTVM and oscilloscope vertical input to right channel output lug (terminal 1R)</td>
<td>Z 421 top</td>
<td>Maximum reading on VTVM; clean 1000 cps sine wave on oscilloscope</td>
</tr>
<tr>
<td>4</td>
<td>Same as Step 1</td>
<td>Composite MPX; 1000 cps on right channel only</td>
<td>±75 kc</td>
<td>Same as Step 3</td>
<td>MPX separation control (R 424)</td>
<td>Minimum reading on VTVM should be at least 33 db below reading obtained in Step 3.</td>
</tr>
<tr>
<td>5</td>
<td>Same as Step 1</td>
<td>Same as Step 4</td>
<td>±75 kc</td>
<td>VTVM and oscilloscope vertical input to right channel output lug (terminal 1S)</td>
<td>——</td>
<td>Same VTVM reading as obtained in Step 3 ± 2 db. Clean 1000 cps sine wave on oscilloscope</td>
</tr>
<tr>
<td>6</td>
<td>Same as Step 1</td>
<td>Composite MPX; 1000 cps on left channel only</td>
<td>±75 kc</td>
<td>Same as Step 5</td>
<td>MPX separation control (R 424), if necessary*</td>
<td>Minimum reading on VTVM should be at least 33 db below reading obtained in Step 5.</td>
</tr>
</tbody>
</table>

* If adjustment is required, adjust for best compromise readings in Steps 4 and 6.
ALTERNATE ALIGNMENT PROCEDURE

For multiplex generators without an RF output

When using this alignment procedure, it is necessary to disconnect the ratio detector from the multiplex decoder at the point where the generator is connected. Unsolder point 1T carefully. The generator input must be through a simple low-pass filter—a 12-K resistor between the multiplex generator and the MPX input with a 180-pF capacitor from the MPX input end of the resistor to ground (Figure 2).

TEST EQUIPMENT REQUIRED: MULTIPLEX GENERATOR, AUDIO (AC) VTVM, 100 KC OSCILLOSCOPE WITH EXTERNAL SWEEP JACKS, ALIGNMENT TOOL.

| TABLE 2 |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| STEPS | GENERATOR CONNECTION | INDICATOR LEVEL | INDICATOR TYPE AND CONNECTION | ALIGNMENT | INDICATION |
| 1 | Composite output of MPX generator to input of MPX demodulator (Point 1) | 19 kc pilot only (100 mV RMS) | AC VTVM to TP-421 top and bottom | Z.421 | Maximum reading on VTVM |
| 2 | 19 kc output of generator to oscilloscope horizontal input, generator not connected to MPX section | —— | Oscilloscope vertical input to TP-422 | Z.422 | Set frequency of free-running oscillator as close as possible to 38 kc. Lissajous pattern (see figure 3) should be as slow-moving as possible. |
| 3 | Same as Step 1 | 1000 cps on left channel only (0.7 V RMS) | AC VTVM and oscilloscope vertical input to left channel output lead (terminal 18) | Z.421 top | Maximum reading on VTVM, clean 1000 cps sine wave on oscilloscope |
| 4 | Same as Step 1 | 1000 cps on right channel only (0.7 V RMS) | Same as Step 3 | MPX separation control (R.424) | Minimum reading on VTVM should be at least 33 db below reading obtained in Step 3 |
| 5 | Same as Step 1 | Same as Step 4 | VTVM and oscilloscope vertical input to right channel output lead (terminal 15) | —— | Same VTVM reading as obtained in Step 3 (±2 db), clean 1000 cps sine wave on oscilloscope |
| 6 | Same as Step 1 | 1000 cps on left channel only (0.7 V RMS) | Same as Step 5 | MPX separation control (R.424) | Minimum reading on VTVM should be at least 33 db below reading obtained in Step 5 |

* If adjustment is required, adjust for best compromise readings in Steps 4 and 5.
**49T TUNER-PREAMPLIFIER (Continued)**

| R14 | 2.2M, 5%, 1/3W |
| R15 | 4.7M, 5%, 1/3W |
| R16, 17 | 220K, 5%, 1/3W |
| R18 | Composition, 470, 10%, 1/2W |
| R19, 20 | 4.7M, 5%, 1/3W |
| R21 | Deleted |
| R22 | Composition, 47K, 10%, 1/2W |
| R23, 24 | 100K |
| R25 | 180K, 5%, 1/3W |
| R26, 27 | 150K |
| R28 | Composition, 1.5K, 10%, 1/2W |
| R29 | Composition, 150K, 10%, 1/2W |
| R30 | Composition, 22K, 10%, 1/2W |
| R31 | Composition, 100, 10%, 1/2W |
| R32 | Composition, 10K, 1%, 1W |
| R33, 34 | Composition, 1K, 10%, 1/2W |
| R35, 36 | 1M |
| R37 | 180 |
| R38 | 22K |
| R39, 40 | 390K |
| R41 | Composition, 1000, 1%, 1/2W |
| R42 | Composition, 1000, 1%, 1/2W |
| R43 | Composition, 1500, 1%, 1/2W |
| R44 | 2.7M, 5%, 1/3W |
| R45 | Composition, 1500, 1%, 1/2W |
| R46 | 2.7M, 5%, 1/3W |
| R47 | 150K |
| R48 | 47K, 5%, 1/3W |
| R49 | Composition, 220, 10%, 1/2W |
| R50 | 100K, 5%, 1/3W |
| R51 | 1K, 5%, 1/3W |
| R52 | 100K, 5%, 1/3W |

**MISCELLANEOUS**

| CR1 | Diode |
| CR1 | Printed Circuit Board |

**49A AMPLIFIER • PARTS DESCRIPTION LIST**

### CAPACITORS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1, 2</td>
<td>Mylar, 0.022uF, 250V</td>
<td>C50197-49</td>
</tr>
<tr>
<td>C3, 4</td>
<td>Electrolytic, 100uF, 15V</td>
<td>C50483-5</td>
</tr>
<tr>
<td>C5, 6</td>
<td>Ceramic, 24pF, 5%, 1500, 1000V</td>
<td>C50070-8</td>
</tr>
<tr>
<td>C7, 8</td>
<td>Electrolytic, 20uF, 250V</td>
<td>C50475-3</td>
</tr>
<tr>
<td>C9, 10</td>
<td>Electrolytic, 6uF, 10V</td>
<td>C50483-10</td>
</tr>
<tr>
<td>C11, 12</td>
<td>Ceramic, 10pF, 10%, 1000V</td>
<td>C50072-14</td>
</tr>
<tr>
<td>C15, 16</td>
<td>Ceramic, 330pF, 10%, 1000V</td>
<td>C50072-1</td>
</tr>
<tr>
<td>C17, 18</td>
<td>Electrolytic, 4uF, 350V</td>
<td>C50475-4</td>
</tr>
</tbody>
</table>

### RESISTORS AND POTENTIOMETERS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1, 2</td>
<td>1M</td>
<td></td>
</tr>
<tr>
<td>R3</td>
<td>220K, 5%, 1/3W</td>
<td></td>
</tr>
<tr>
<td>R4</td>
<td>1K</td>
<td></td>
</tr>
<tr>
<td>R5</td>
<td>82</td>
<td></td>
</tr>
<tr>
<td>R6</td>
<td>220K, 5%, 1/3W</td>
<td></td>
</tr>
<tr>
<td>R7</td>
<td>1.8K</td>
<td></td>
</tr>
<tr>
<td>R8</td>
<td>82</td>
<td></td>
</tr>
<tr>
<td>R9, 10</td>
<td>22K</td>
<td></td>
</tr>
</tbody>
</table>

**Deposited Carbon in ohms, 5% Tolerance, 1/8 watt unless otherwise noted. K=Kiloohms, M=Megohms.**


**R11, 12 | K** 1K R12DC102J
**R13A, B | Wirewound, 6.8K, 10%, 7W** RPG7682K
**R14 | Deleted** R12DC182J
**R15, 16 | 1.8K** R12DC182J
**R17, 18 | 10K** R12DC103J
**R19 | Composition, 330, 1%, 2W** R12DC182J
**R20, 21 | Deleted** R12DC182J
**R22 | Composition, 330, 1%, 2W** R12DC182J

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**R101DC02J**
**MISCELLANEOUS**

- CR1, 2 Diode, Silicon Rectifier
- CR3, 4, 5, 6 Diode, Silicon Rectifier
- F1, 2, 3, 4 Fuse, 2 Ampere
- F3 Fuse, 3.2 Ampere, Slo-Blo
- Q1, 2, 3, 4 *Transistor, Power, 35T14
- T3 Transformer, Driver (left)
- T2 Transformer, Driver (right)
- T3 Transformer, Power

*Transistor must be replaced with one from some Beta group, as indicated by the color dot on the transistor, unless both transistors are replaced with a matched pair. (Always replace one insulator when replacing transistor.)

**OUTPUT-STAGE BASE-BIAS CIRCUIT MODIFICATION**

The critical adjustment of the base-bias adjusting potentiometers (P1, P2, P3, P4—in the main schematic) is eliminated by replacing the controls with voltage and temperature compensating diodes. These diodes will keep the base-bias voltage within 0.015 volt of the selected value even when the supply voltage varies (+15%). Whenever the circuit should be made both the right

- Remove the 10-ohm
- Remove the 10-ohm
- Remove the 0.5-ohm
- Install a 0.75-ohm, 5
- Install the diodes in place of the 10-ohm

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49A AMPLIFIER

POWER CONSUMPTION
ZERO IN = 90W, 105VA
2 X 25W RMS = 160W, 310VA

AMIF 2282 PI35 SCHEMATIC
AMPLIFIER CHASSIS A49

The output-stage base-bias circuit modification is identical for both the left and right channels. Only the part-callout numbers (symbols) are different. The above schematic insert is for the right channel.

LLANEUSE
MCS 041-1
MCS 05015
FTS-155-145
F235014
F1105-155-1
F1155-155-1
F1115-155-1

STANDARD
DO NOT USE EXTERNAL SPEAKERS WITH IMP.

dANCES BELOW 4 OHMS

SSF

NOTICE:
SELECTOR SWITCH SHAFT AND ARROW
(SHOWN FOR LOCATION ONLY) ARE IN
MAXIMUM COUNTERCLOCKWISE
POSITION.

VOLTAGE MEASURED TO CHASSIS WITH
20,000 OHM PER VOLT DC VOMETER
WITH AMPLIFIER INPUT SHORTED.

SPEAKER SELECTOR SWITCH
(BOTH SECTIONS ARE VIEWED FROM FRONT)

FRONT

REAR

RIGHT

LEFT

NOTE:
SELECTOR SWITCH SHAFT AND ARROW
(SHOWN FOR LOCATION ONLY) ARE IN
MAXIMUM COUNTERCLOCKWISE
POSITION.

VOLTAGE MEASURED TO CHASSIS WITH
20,000 OHM PER VOLT DC VOMETER
WITH AMPLIFIER INPUT SHORTED.
TROUBLESHOOTING GUIDE

Does not go on – (pilot or dial lamps do not light) in any position of SELECTOR switch.

Check: Fuse F5, the power cord and plug, wall outlet, AUTO SHUTOFF switch S3, Power switch S2, J15 and its plug and interconnecting cable.

Does not go on – (pilot or dial lamps do not light) only in PHONO positions of the SELECTOR switch.

Check: AUTO SHUTOFF switch S3, J15 and its plug and interconnecting cable, the turntable switch and the changer connector.

Distortion (both channels) in any position of the SELECTOR switch.
Hum or No audio output Disconnect reverberation unit from REV IN REV OUT jacks and insert jumpers (a must).

Check: Speaker switch position and its operation Speaker connectors and plugs.
Test (filament leakage for hum) V10, V201 or substitute.
+24 and −24-volt transistor-amplifier power supply (C23, C28, CR3, CR4, CR5, CR6).
+21 and −21-volt DC filament supply for V8, V9, V10 and V201 (C21, C22, R45, R46).

Distortion (LEFT channel only) SELECTOR in PHONO and FM positions.
Hum or Remove plug from J5 (LEFT RCRDR OUT)
No audio output Remove plugs from J6, J7 (REV IN, REV OUT) and insert jumpers.

Check: Plug in J13 and interconnecting cable to amplifier chassis. Position of BALANCE control, Q1, Q2 and bias setting (P1 and P2).
Test (filament leakage for hum) V10, V201, V202.

Distortion (RIGHT channel only) SELECTOR in PHONO and FM positions.
Hum or Remove plug from J10 (LEFT RCRDR OUT)
No audio output Remove plugs from J11, J12 (REV IN, REV OUT) and insert jumper.

Check: Plug in J14 and interconnecting cable to amplifier chassis. Position of BALANCE control, Q3, Q4 and bias setting (P3 and P4).

Distortion (LEFT channel only) SELECTOR in PHONO positions only.
Hum or Remove plug from J1 (LEFT PHONO INPUT).
No audio output Test (filament leakage for hum) V8 or substitute.

Check: +21, −21-volt power supply (R45, 46, C1, 22).

Distortion (RIGHT channel only) SELECTOR in PHONO positions only.
Hum or Remove plug from J2 (RIGHT PHONO INPUT).
No audio output (filament leakage for hum) V9 or substitute.

Check: +21, −21-volt supply (R45, 46, C21, 22).

Distortion (both channels) FM only – SELECTOR in MONO and AUTO positions.
Hum or Tune to other stations.
No audio output

Check: Antenna position and connections, Relay K421 and detector alignment. Test (filament leakage for hum) V1, V2, V3, V4, V5, V6, V401.

Distortion (both channels) FM AUTO position of SELECTOR ONLY.
Hum or Tune to other stations.
No audio output Try FM MONO and FM STEREO FILTER positions.

Check: Antenna position and connections, Multiplex decoder (alignment, etc.) Relay K421 on MPX subchassis.
Test (filament leakage for hum) V401, V402, D401 or substitute.

STEREO BEACON does not work
Check: Relay K421 on MPX subchassis.
Test: V402, CR401, CR402

Distortion AM only Tune to other stations.
Hum or Check: AM antenna or connect 15 to 20 – feet wire to AM antenna terminal temporarily.
No audio output Test (filament leakage for hum) V2, V3, V4 and CR1.
PREFERRED ALIGNMENT PROCEDURE

READ THESE INSTRUCTIONS VERY CAREFULLY BEFORE ATTEMPTING ALIGNMENT

CONTROL POSITIONS:
- Rotate tuning knob to set dial pointer to the zero index mark on logging scale (if the pointer will not go to zero without forcing reset the pointer.)
- Set volume control to minimum (full counterclockwise).
- Disconnect the external antennas and the AM antenna link.
- Disable the AGC for AM RF alignment – just short across C18 or C80.

FM SIGNAL GENERATOR: Modulated 30% (± 22.5 deviation at 400 cps.).

ALIGNMENT PRECAUTIONS:
- The chassis and the test instruments must be warmed up for at least 15 minutes to reduce any possible drift.
- Adjust the AC powerline input for 117 VAC to the chassis (50 to 60 cycle).
- Use only the proper, fully insulated, alignment tools.

AM ALIGNMENT

<table>
<thead>
<tr>
<th>STEPS</th>
<th>CHASSIS</th>
<th>SIGNAL GENERATOR</th>
<th>INDICATOR</th>
<th>ALIGNMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SELECTOR</td>
<td>STATION SELECTOR</td>
<td>COUPLING</td>
<td>FREQ.</td>
</tr>
<tr>
<td>1</td>
<td>AM</td>
<td>Point of no signal and no interference</td>
<td>AM Gen. connected thru .12uf cap to V2, Pin 1</td>
<td>455 KC</td>
</tr>
<tr>
<td>2</td>
<td>AM</td>
<td>600 KC</td>
<td>AM Gen. connected thru 220 uf cap to the AM antenna terminal Disconnect link.</td>
<td>600 KC</td>
</tr>
<tr>
<td>3</td>
<td>AM</td>
<td>1400 KC</td>
<td>AM Gen. connected thru 320 uf cap to the AM antenna terminal Disconnect link.</td>
<td>1400 KC</td>
</tr>
</tbody>
</table>

4. Repeat steps 2 and 3 for proper dial calibration and output.

FM ALIGNMENT

<table>
<thead>
<tr>
<th>STEPS</th>
<th>CHASSIS</th>
<th>SIGNAL GENERATOR</th>
<th>INDICATOR</th>
<th>ALIGNMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SELECTOR</td>
<td>STATION SELECTOR</td>
<td>COUPLING</td>
<td>FREQ.</td>
</tr>
<tr>
<td>5</td>
<td>FM</td>
<td>Point of no signal and no interference</td>
<td>FM Gen. connected to ungrounded tube shield over V1</td>
<td>10.7 MC</td>
</tr>
<tr>
<td>6</td>
<td>FM</td>
<td>Point of no signal and no interference</td>
<td>FM Gen. connected thru two 120-ohm carbon resistors (Figure 1) to the FM Normal Antenna terminals</td>
<td>10.7 MC</td>
</tr>
<tr>
<td>7</td>
<td>FM</td>
<td>90 MC</td>
<td>FM Gen. connected thru two 120-ohm carbon resistors (Figure 1) to the FM Normal Antenna terminals</td>
<td>90 MC</td>
</tr>
<tr>
<td>8</td>
<td>FM</td>
<td>105 MC</td>
<td>FM Gen. connected thru two 120-ohm carbon resistors (Figure 1) to the FM Normal Antenna terminals</td>
<td>106 MC</td>
</tr>
</tbody>
</table>

9. Repeat steps 7 and 8 at least once for proper dial calibration and maximum output.

NOTE: For calibrating both the AM and FM, use as low an output voltage as possible from your signal generator.

POWER OUTPUT MEASUREMENT

The power-output stage of this unit is designed to deliver its full-rated power with program material (voice or music) into 4- to 16-ohm loads for indefinite periods. When a constant audio tone is used as a signal to measure the continuous RMS power output certain precautions must be taken.
- Measure the power output of one channel at a time.
- Limit the measurement period to 10 minutes (with a load resistance between 4 and 16 ohms). Should it ever be necessary to measure the power output of both channels simultaneously, use a load of 4 or 8 ohms (per channel).
- Limit measurement to a period no longer than 1 minute for a 4-ohm load or to 5 minutes for an 8-ohm load.

etc.)